

# VECTO 3.x

28.07.2017



## Release Notes

# Vecto 3.2.0.940

2017-07-28

## Bugfixes

- [VECTO-546] - GearboxCertificationOptionType Option 2 not accepted by VECTO
- [VECTO-547] - Engine Manufacturer and Engine Model are empty in .vsum
- [VECTO-548] - online user manual
- [VECTO-549] - Inconsistent (and wrong) decimal separator in XML output (manufacturer report)
- [VECTO-551] - Average Tyre RRC not in Customer Information File output
- [VECTO-536] - GUI: improvements vehicle dialog (add missing pictures for vehicle categories)
- [VECTO-550] - Allow custom settings for AirDensity in Engineering mode
- [VECTO-552] - set engine rated power, rated speed to computed values from FLD if not provided as input

# Vecto 3.2.0.925

2017-07-14

## Improvements

- [VECTO-366] added EMS vehicle configuration, EMS is only simulated when engine rated power > 300kW
- [VECTO-463] add pneumatic system technology 'vacuum pump'
- [VECTO-465] change RRC value of trailers (declaration mode) from 0.00555 to 0.0055 (due to limits in user interface)
- [VECTO-477] AT Gearbox, powershift losses: remove inertia factor
- [VECTO-471] update cross-wind correction model: height-dependent wind speed (see Excel spreadsheet in User Manual folder for details)
- [VECTO-367] Add Vehicle Design Speed to segmentation table
- [VECTO-470] Add XML reading and export functionality
- [VECTO-486] Adding hashing library
- [VECTO-469] Limit engine max torque (either due to vehicle or gearbox limits), limit gearbox input speed
- [VECTO-466] Update vehicle payloads: 10% loaded and reference load are simulated
- [VECTO-467] Add generic PTO activation in municipal cycle
- [VECTO-468] Add PTO losses (idle) in declaration mode
- [VECTO-479] Added PTO option 'only one engaged gearwheel above oil level' with 0 losses

# Vecto 3.2.0.925

2017-07-14

## Improvements

- [VECTO-483] Adapt CdxA supplement for additional trailers
- [VECTO-494] Implementation of different fuel types
- [VECTO-502] Implementing standard values for air-drag area (if not measured)
- [VECTO-501] Implement engine idle speed set in vehicle (must be higher than engine's idle speed value)
- [VECTO-504] Adding HVAC technology 'none'
- [VECTO-489] Extrapolate gearbox lossmaps (required when torque limitation by gearbox is ignored)
- [VECTO-505] Implement AT transmissions in declaration mode
- [VECTO-507] Allow to ignore validation of model data when starting a simulation (significant improvement on simulation startup time - about 10s)
- [VECTO-506] modified method how torque-converter characteristics in drag is extended. allow drag-values in the input, only add one point at a high speed ratio
- [VECTO-509] Add axle-type (vehicle driven, vehicle non-driven, trailer) to GUI
- [VECTO-511] Add engine idle speed to Vehicle input form (GUI)
- [VECTO-510] Write XML reports (manufacturer, customer information) in declaration mode
- [VECTO-474] new driving cycles for Municipal and Regional Delivery

# Vecto 3.2.0.925

2017-07-14

## Improvements

- [VECTO-522] step-up ratio for using torque converter in second gear set to 1.85 for busses (still 1.8 for trucks)
- [VECTO-525] remove info-box with max loading in GUI
- [VECTO-531] Payload calculation: limit truck payload to the truck's max payload. (earlier versions only limited the total payload of truc + trailer to the total max. payload, i.e. allowed to shifted loading from truck to the trailer)
- [VECTO-533] allow second driven axle, rdyn is calculated as average of both driven axles
- [VECTO-537] new Suburban driving cycles
- [VECTO-541] increase declaration mode PT1 curve to higher speeds (2500 is too low for some engines)
- [VECTO-542] reduce overspeed in declaration mode to 2.5km/h

# Vecto 3.2.0.925

2017-07-14

## Bugfixes

- [VECTO-462] fix: decision if PTO cycle is simulated
- [VECTO-473] fix: adapt range for validation of torque converter characteristics
- [VECTO-464] fix: extrapolation of engine full-load curve gives neg. max. torque. Limit engine speed to n95h
- [VECTO-480] fix: a\_pos in .vsum was less than zero
- [VECTO-487] fix: Duration of PTO cycle was computed incorrectly if PTO cycle does not start at t=0
- [VECTO-514] fix: sort entries in .vsum numerically, not lexically
- [VECTO-516] fix: consider axlegear losses for estimation of acceleration after gearshifts
- [VECTO-517] fix: valid shift polygon was considered invalid when extended to very high torque ranges
- [VECTO-424] fix: VectoCore.dll could not be found when the current working directory is different to the directory of the vectocmd.exe
- [VECTO-425] fix: vectocmd.exe - check if the output is redirected, and skip updating of the progress bar when this is the case
- [VECTO-426] fix: vectocmd.exe - log errors to STDERR
- [VECTO-519] fix: computation of n95h fails for a valid full-load curve due to numerical inaccuracy. add tolerance when searching for solutions
- [VECTO-520] fix: gearshift count in vsum is 0

# Vecto 3.1.2.810

## 2017-01-18

### Improvements

- [VECTO-445] Additional columns in vsum file
- Allow splitting shift losses among multiple simulation intervals
- Allow coasting overspeed only if vehicle speed  $> 0$
- Torque converter: better handling of 'creeping' situations

### Bugfixes:

- [VECTO-443] Bugfix in AMT shift strategy: skip gears not working correctly

# Vecto 3.1.2.796

2017-03-07

## Improvements:

- [VECTO-405] Adding clutch-losses for AMT/MT gearboxes during drive-off, reduce drive-off distance after stop from 1m to 0.25m, set clutch closing speed (normalized) to 6.5%, changes in clutch model
- [VECTO-379] Make GUI more tolerant against missing files. Instead of aborting reading the input data the GUI shows a suffix for missing input files
- [VECTO-411] Allow a traction interruption of 0s for AMT/MT gearboxes
- [VECTO-408] Gearbox Inertia for AT gearboxes set to 0
- [VECTO-419] Adapted error messages, added list of errors
- [VECTO-421, VECTO-439] Added volume-related results to vsum file (volume is computed based on default bodies)
- [] Energy balance (vsum) and balance of engine power output and power consumers (vmod) level
- [VECTO-430] AT shift strategy: upshifts may happen too early
- [VECTO-431] AMT shift strategy always started in first gear due to changes in clutch model
- [VECTO-433] adapt generic vehicles: use typical WHTC correction factors
- [VECTO-437] set vehicle speed at clutch-closed to 1.3 m/s
- [VECTO-436] fix simulation aborts with AT gearbox (neg. braking power, unexpected response, underload)

## Bugfixes:

- [VECTO-415] Powershift Losses were not considered for AT gearboxes with PowerSplit
- [VECTO-416] Measured Speed with gear failed when cycle contained parts with eco-roll (computation of next gear failed)
- [VECTO-428] Sum of timeshares adds up to 100%
- [VECTO-429] Min Velocity for lookahead coasting was not written to JSON file



# Vecto 3.1.1.748

2017-01-18

## Bugfixes:

- [VECTO-404] Driving Cycle with PTO stopped simulation after first PTO activation

# Vecto 3.1.1.742

2017-01-12

## Improvements:

- [VECTO-390, VECTO-400] Adapt engine speed to estimated engine speed after gear shift during traction interruption (double clutching)
- [VECTO-396, VECTO-388] Add shift losses for AT power shifts
- [VECTO-389] new gear shift rules for AT gearboxes
- [VECTO-387] added max input speed for torque converter
- [VECTO-385] Automatically add generic torque converter data for drag
- [VECTO-399] Add missions and loadings for vehicle categories 11, 12, and 16 (declaration mode)
- [VECTO-384] cleanup memory after simulation run
- [VECTO-394] new option for vectocmd to disable all output
- [VECTO-392] make the GUI scale depending on the Windows font size
- [VECTO-391] Gearbox output speed and output torque added to .vmod files
- [VECTO-386] Gearbox window: disable input fields not applicable for the selected gearbox type

## Bugfixes:

- [VECTO-401] Computation of  $n_{95h}$  etc. fails if engine's max torque is constant 0
- Lookup of Airdrag parameters in declaration mode
- [VECTO-378] Improved file-handling in AAUX module

# Vecto 3.1.0.683

2016-11-14

## Bugfixes:

- [VECTO-375] Fixed bug when braking during slope change from negative to positive values.
- [VECTO-372] Added check for unusual acceleration/deceleration data which could lead to error when halting.
- [VECTO-371] Added additional behavior to overcome such situations
- [VECTO-370] Added additional behavior to overcome such situations
- [VECTO-369] CrosswindCorrection is now saved and read again from JSON files
- [VECTO-373] WHTC-Engineering correction factor now correctly read/write in JSON files
- [VECTO-368] Fixed validation for specific cases when values are intentionally invalid.
- [VECTO-357] Updated GUI to not show ECO-Roll option to avoid confusion
- Fixed numerous bugs in AT-ShiftStrategy regarding the Torque Converter
- Fixed numerous bugs in MeasuredSpeed Mode (and MeasuredSpeed with Gear) in connection with AT-Gearbox and TorqueConverter
- Fixed a bug when PTO-Cycle was missing
- Corrected axle loss maps for Generic Vehicles in Declaration Mode to match technical annex
- Corrected SumFile Cruise Time Share. Added that timeshares must add up to 100%

# Vecto 3.1.0.683

2016-11-14

## Improvements:

- [VECTO-355] Updated documentation, added powertrain schematics in chapter "Simulation Models"
- [VECTO-374] Check range for Torque Converter speed ratio input data to be at least between 0 and 2.2
- Updated many error messages to be more explicit about the reason of error
- Added "Mission Profiles" Directory with driving cycles publicly available in the application root directory.
- Added "Declaration" directory with the declaration data files in the application root directory.
- Added warning when engine inertia is 0
- Added check that engine speed must not fall below idle speed (even in measured speed mode)
- Shift curve validation for AT gearboxes: shift curves may now overlap due to different shift logic in AutomaticTransmissions.
- Updated Crosswind Coefficients for Tractor+Semitrailer

# Vecto 3.1.0.662

2016-10-24

- **Bugfixes:**

- [VECTO-360] Fixed error during startup of VECTO (loading of DLLs).
- [VECTO-358] Fixed errors during simulation where vehicle unintentionally was driving backwards. Fixed 1Hz-Filter for ModFiles (distance was wrong under certain circumstances, vehicle seemingly jumping back before halt)
- [VECTO-361] Fixed classification of vehicles with GVM of exactly 7500kg
- [VECTO-364] Fixed an error in measured speed mode (run aborts).
- [VECTO-363] Compute shift polygons in declaration mode now uses correct boundary for full load margin.
- [VECTO-365] Fixed editing gears in declaration mode

- **Improvements:**

- [VECTO-355] User Manual updated (Screenshots, Descriptions, File Formats, Vecto V2 Comments removed).
- [VECTO-317] Declaration data for Wheel sizes updated
- [VECTO-359] Simplified code regarding PT1 behavior.
- [VECTO-323] PTO-Cycle may now be left empty when not used in driving cycle.

# Vecto 3.1.0.652

2016-10-14

- Main Updates
  - Removed VECTO Core 2.2
  - Refactoring of the User-Interface Backend: loading, saving files and validating user input uses Vecto 3 models
  - AT-Gearbox Model: differentiate between AT gearbox with serial torque converter and AT gearbox using powersplit
  - Numbering of gears with AT gearbox corresponds to mechanical gears, new column TC\_locked in .vmod file to indicate if torque converter is active
  - Torque converter gear no longer allowed in input (added by Vecto depending on the AT model)
  - New implementation of torque converter model (analytic solutions)
  - Added PTO option for municipal utility vehicles: PTO idle losses, separate PTO cycle during standstill
  - Added Angledrive Component
  - Option for constant Auxiliary Power Demand in Job-File

## Vecto 3.1.0.652

2016-10-14

- Main Updates (cont.)
  - Normalize x/y values before triangulating Delaunay map (transmission loss-maps, fuel consumption loss map)
  - Additional fuel consumption correction factor in declaration mode: cold/hot balancing factor
  - Added fuel consumption correction factor (WHTC, Cold/Hot balancing, ...) in engineering mode
  - Update auxiliaries power demand according to latest whitebook
  - Allow multiple steered axles
  - Adapted engine idle controller (during declutch) – engine speed decreases faster
  - SUM-File: split E\_axl\_gbx into two columns, E\_axl and E\_gbx
  - New columns in mod-file: PTO, torque converter
  - Removed full-load curve per gear, only single value MaxTorque
  - Removed rims (dynamic wheel radius depends on wheel type)
  - Fixes in AAUX module: open correct file-browser, save selected files

# Status quo VECTO software and open issues (Oct. 2016)

## Next issues on the to do list

- **Further development of the AT model**  
Consideration of losses during power shifts, update of gear shift logics
- **Reimplementation of engine stop/start**
- **Declaration mode: implementation of EMS vehicle configurations**

### Items waiting for decision on methods and resources:

- **Update engine data (according to update of Annex II)**  
Other fuels than diesel, “top torque” feature, correction factor for periodic regenerating DPFs
- **Declaration mode:**
  - **Revision of calculated vehicle loads**
  - **implementation of refuse cycle (instead “municipal”)**  
Update of driving cycle, consideration of generic PTO loads during collection part, generic body weight and payload
  - **VECTO output (approval authorities, customer info, monitoring)**
  - **Buses**
- **Predictive ADAS**



# **Vecto 3.0.4.565**

**2016-07-19**

- Bugfixes
  - AAUX HVAC Dialog does not store path to ActuationsMap and SSMSource
  - GUI: check for axle loads in declaration mode renders editing dialog useless
  - Vecto 2.2: Simulation aborts (Vecto terminates) when simulating EngineOnly cycles
  - Vecto 3: Building SimulationRun EngineOnly simulation failed

# Vecto 3.0.4.544

2016-06-28

- Main Updates
  - New gear shift strategy according to White Book 2016
  - New coasting strategy according to White Book 2016
  - New input parameters (engineering mode) for coasting and gear shift behavior
  - Use SI units in Advanced Auxiliaries Module and compile with strict compiler settings (no implicit casts, etc.)
  - Allow efficiency for transmission losses (in engineering mode)
- Bugfixes
  - Auxiliary TechList not read from JSON input data
  - Improvements in driver strategy
  - Bugfixes in MeasuredSpeed mode

## Notes for using Vecto 3.x with AAUX (1)

- The AdvancedAuxiliaries module requires the number of activations for pneumatic consumers (brakes, doors, kneeling) and the (estimated) total cycle time. This can be configured in the .APAC-file (actuators file). For standard bus/coach cycles (i.e., the cycle file contains “bus” **and** “heavy\_urban” or “suburban” or “interurban” or “urban”; **or** the cycle contains “coach” (*case insensitive*)) the actuators file already contains the number of activations and the cycle time. For other cycles the filename without extension is used to lookup the activations in the .APAC file (*case sensitive*)

## Notes for using Vecto 3.x with AAUX (2)

- Vecto 3 uses an average auxiliaries load (determined by the AAUX module depending on the settings) for the simulation. The AAUX module computes the fuel consumption in parallel to VectoCore and accounts for smart consumers (e.g., alternator, pneumatics, ...).
- Output
  - The .vmod file contains both, the fuel consumption calculated by VectoCore (per simulation interval) and AAUX (accumulated and per simulation interval).  
Columns in .vmod file:
    - AA\_TotalCycleFC\_Grams [g]: accumulated fuel consumption as computed by the AAUX model, considering smart consumers
    - FC-Map [g/h]: fuel consumption as computed by VectoCore interpolating in the FC-Map, using an average base load of auxiliaries
    - FC-AUXc [g/h]: fuel consumption corrected due to engine stop/start (currently not applicable)
    - FC-WHTCc [g/h]: WHTC-corrected fuel consumption (not applicable in engineering mode)
    - FC-AAUX [g/h]: fuel consumption per simulation interval, derived from AA\_TotalCycleFC\_Grams
    - FC-Final [g/h]: final fuel consumption value with all (applicable) corrections applied (stop/start, WHTC, smart auxiliaries)

## Notes for using Vecto 3.x with AAUX (3)

- Output .vsum
  - Columns in .vsum file:
    - FC-Map: total fuel consumption as computed by VectoCore interpolating in the FC-Map, using an average base load of auxiliaries
    - FC-AUXc: total fuel consumption corrected due to engine stop/start (currently not applicable)
    - FC-WHTCc: WHTC-corrected fuel consumption (not applicable in engineering mode)
    - FC-AAUX: fuel consumption per simulation interval, derived from AA\_TotalCycleFC\_Grams
    - FC-Final: final fuel consumption value with all (applicable) corrections applied (stop/start, WHTC, smart auxiliaries)

# Vecto 3.0.3.537

2016-06-21

- Main Updates
  - Plot shift lines as computed according to WB 2016 declaration mode in GUI
- Bugfixes
  - GUI: Buttons to add/remove auxiliaries are visible again
  - Error in calculation of WHTC correction factor
  - Fix: consider gearbox inertia (engineering mode) for searching operating point
  - Wrong output of road gradient in measured speed mode (correct gradient for simulation)
  - Fuel consumption in .vsum file now accounts for AdvancedAuxiliaries model
  - GraphDrawer (Vecto): handle new .vmod format of Vecto 3
  - AdvancedAuxiliaries: language-settings independent input parsing
  - Paux was ignored when running Vecto 2.2
  - Error in massive multithreaded execution
  - Fix unhandled response during simulation
  - Fix output columns in .vmod

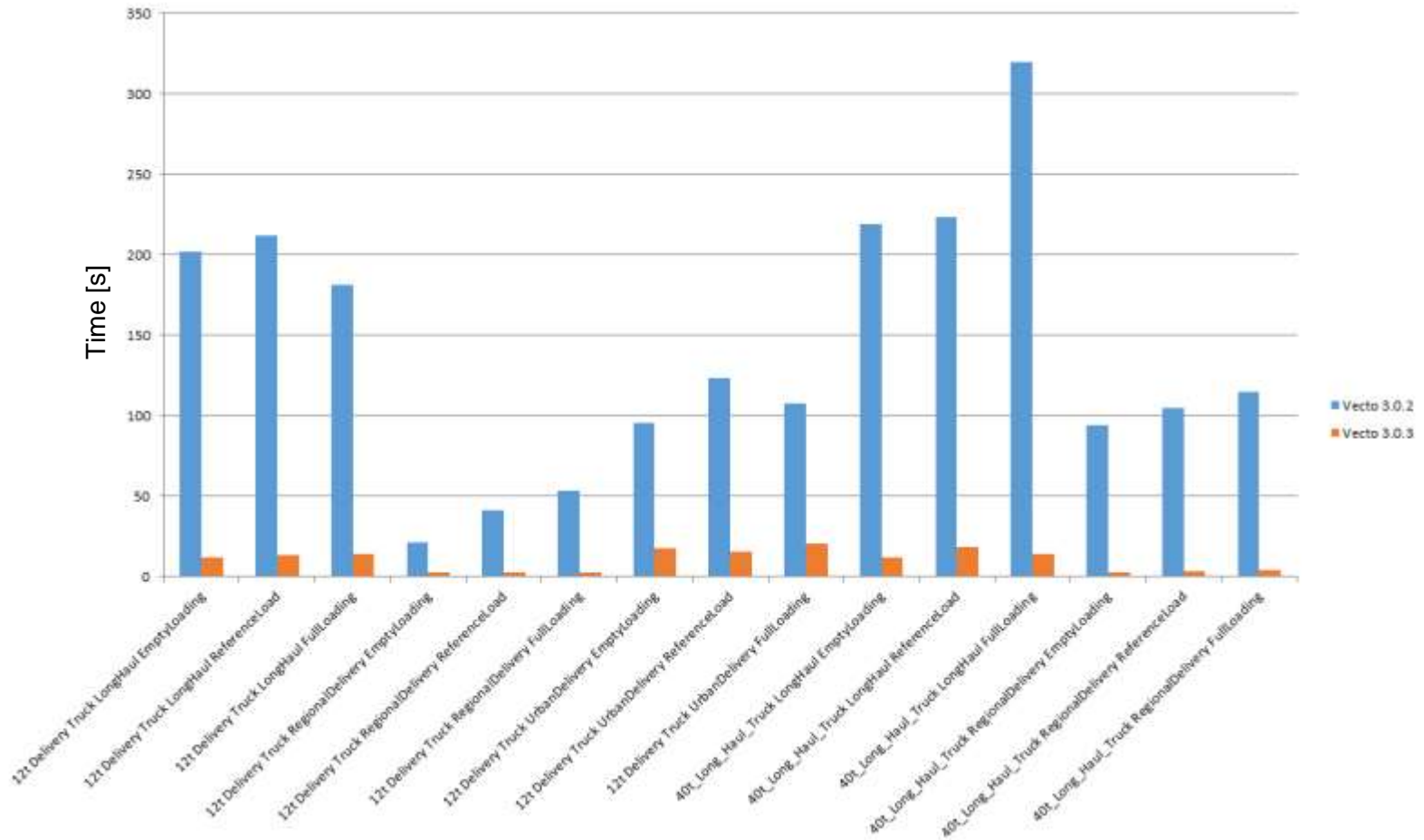
# Vecto 3.0.3.495

2016-05-10

- Main Updates
  - Support for Advanced Auxiliaries (Ricardo) in Vecto 3.0.3 and Vecto 2.2
  - Performance improvements
  - Gearshift polygons according to WB 2016
  - Revision of SUM-data file, changed order of columns, changed column headers
- Bugfixes
  - Delaunay Maps: additional check for duplicate input points
  - Creation of PDF Report when running multiple jobs at once
  - Sanity checks for gear shift lines
  - Improvements DriverStrategy: handling special cases

# Performance Comparison

Execution Times (all 15 runs in parallel)



Total execution time (15 runs in parallel): Vecto 3.0.2: 6min 6s; **Vecto 3.0.3: 35s**



# VECTO 3.0.2

2016-03-11

## Main updates

- New simulation modes:
  - Pwheel (SiCo),
  - Measured Speed (with/without gear)
  - $v_{\text{air}}$ /beta cross-wind correction (vcdb)
- Adaptations of powertrain components architecture
  - Move wheels inertia from vehicle to wheels
  - Auxiliaries no longer connected via clutch to the engine but via a separate port
  - Engine checks overload of gearbox and engine overload
- Fixed some driving behavior related issues in VectoCore:
  - When the vehicle comes to a halt during gear shift, instead of aborting the cycle, it tries to drive away again with an appropriate gear.
- ModData Format changed for better information and clarity
- Added validation of input values (according to latest VectoInputParameters.xls)
- Various bugfixes

## Pwheel (SiCo) Mode

- Function as already available in Vecto 2.2 also added in Vecto 3.0.2
  - Driving cycle specifies power at wheel, engine speed, gear, and auxiliary power
  - No driver model in the simulation.
  - The Vecto gear-shift model is overruled.
  - Function used for creating reference results for SiCo tests
  - For details see user manual: Simulation Models / Pwheel Input (SiCo)

## Measured Speed Mode

- Functionality already available in Vecto 2.2 added in Vecto 3.0.2
  - Driving cycle not defined by target speed but by actual speed. No driver model in the simulation.
  - Gear and engine speed can be specified in the driving cycle. In this case the Vecto gear-shift model is overruled.
  - Function used for “proof of concept” purposes
  - For details see user manual: Calculation Modes / Engineering Mode / Measured Speed

## **.vmod File Update**

- In Vecto 3.0.2 the structure of the modal data output has been revised and re-structured. Basically for every powertrain component the .vmod file contains the power at the input shaft and the individual power losses for every component. For the engine the power, torque and engine speed at the output shaft is given along with the internal power and torque used for computing the fuel consumption.
- For details see the user manual: Input and Output / Modal Results (.vmod)

# Changelog 3.0.2

- - New simulation modes:
- + Measured Speed
- + Measured Speed with Gear
- + Pwheel (SiCo)
- - Adaptations of powertrain components architecture
- + Move wheels inertia from vehicle to wheels
- + Auxiliaries no longer connected via clutch to the engine but via a separate port
- + Engine checks overload of gearbox and engine overload
- - Fixed some driving behavior related issues in VectoCore:
- + When the vehicle comes to a halt during gear shift, instead of aborting the cycle, it tries to drive away again with an appropriate gear.
- - [ModData Format](#modal-results-.vmod) changed for better information and clarity
- - Entries in the sum-file are sorted in the same way as in Vecto 2.2
- - In engineering mode the execution mode (distance-based, time-based measured speed, time-based measured speed with gear, engine only) are detected based on the cycle
- - Added validation of input values
- - Gravity constant set to 9.80665 (NIST standard acceleration for gravity)
- - Improved input data handling: sort input values of full-load curves (engine, gbx, retarder)
- - Better Integration of VectoCore into GUI (Notifications and Messages)
- -  $v_{air}/\beta$  cross-wind correction (vcdb) implemented
- - For all calculations the averaged values of the current simulation step are used for interpolations in loss-maps.
- - Allow extrapolation of loss maps in engineering mode (warnings)
- - Refactoring of input data handling: separate InputDataProvider interfaces for model data
- - Refactoring of result handling: separate result container and output writer
- - New Long-Haul driving cycle included
- - User Manual updated for VECTO V3.x
- - Fix: sparse representation of declaration cycles had some missing entries
- - Bugfix: error in computation of engine's preferred speed
- - Bugfix: wrong vehicle class lookup
- - Bugfix: duplicate entries in intersected full-load curves
- - Bugfix: retarder takes the retarder ratio into account for lossmap lookup
- - Bugfix: use unique identifier for jobs in job list
- - Bugfix: error in triangulation of fuel consumption map